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ABSTRACT OF THE DISCLOSURE

A gas-mixture-ignition-time estimation apparatus for an internal combustion engine estimates the temperature of a premixed gas mixture for PCCI combustion (i.e., cylinder interior temperature T_g), while relating it to the angle CA, on the basis of a state quantity of the cylinder interior gas at the time of start of compression (CA_{in}) (heat energy of the cylinder interior gas at the time of start of compression), the amount of a change in the state quantity of the cylinder interior gas attributable to compression in a compression stroke (minute piston work), and the heat generation quantity of a cool flame generated in PCCI combustion prior to autoignition (hot flame) (cool flame heat generation quantity A_{qlto}). A time when the cylinder interior temperature T_g reaches a predetermined autoignition start temperature T_{ig} is estimated as an autoignition start time (CA_{ig}) of the premixed gas mixture related to PCCI combustion. Since the cool flame heat generation quantity O_{qlto} is taken into consideration, the autoignition start time related to PCCI combustion can be estimated accurately.